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**THE ROLE OF KNOWLEDGE PROTECTION IN KNOWLEDGE  
MANAGEMENT SUCCESS MODELS**

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## ABSTRACT

**Mostafa Tanjib Mohiuddin:** the role of knowledge protection in knowledge management success models

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**Keywords:** Knowledge Protection, Knowledge Management Success Model, Knowledge Management Success Factors, Technology commercialization

The world is technologically advancing every day and innovations are coming up frequently. People only feel interested to know about those innovations which create some buzz in the market - the rest of the innovations lost in the bottomless cave of time. One of the primary reasons for such failure is innovators' too much interest in protecting information related to the creation itself. Undoubtedly, the security of knowledge is vital for any invention, but being extensively protective, can also hamper the innovation process and keep the innovator in the dark about users' expectations. Therefore, an innovator needs to determine the boundary of knowledge protection to become successful in commercializing any innovation.

Although the present structure of knowledge management is very multifaceted, yet, its correlation with technology transfer is inherently evident. Therefore, the proposed solution will try to find out some theoretical background to establish a connection between knowledge protection and the knowledge management (KM) success model. The answer will try to discover the status of knowledge protection as a success factor of the knowledge management success model. A systematic literature review conducts to identify and evaluate the works of researchers, scholars in this field. The review starts with finding the right keywords to discover appropriate journals. Next, relevant articles need to obtain from those journals. Information applicable to the research topic emerges after reading the relevant journals.

After the research, it becomes clear that knowledge protection doesn't get the importance that the author expects while selecting the topic. Knowledge related success factors get less importance during the finding of knowledge management success factors. There are only three articles that appear during the research, where they acknowledge the security of knowledge. The almost same observation detects in the case of knowledge management success models. Most of the time, knowledge protection has not taken into account while developing these models. Only one model considers knowledge protection and another model indirectly acknowledges the importance of protection. Though the models consider user satisfaction widely, but the access to knowledge for the users and the barrier of getting that knowledge due to knowledge protection overlooks significantly.

## **PREFACE**

This thesis is a part of the Master of Science in Business and Technology. It has been an excellent opportunity to explore different aspects of knowledge management. The topic chooses out of the author's interest in finding the value of knowledge protection in knowledge management. Ignore the significance of knowledge protection in business and technology field is challenging. The intention of hiding knowledge from users affects the success of any innovation. However, ignorance of such concerns arises the author's curiosity about the topic.

I would like to thank Nina Helander for her suggestions during the writing of the thesis. Furthermore, I would like to thank Ilona Ilvonen for supervising this thesis and her exquisite observations that guide me to envisage the core idea of this thesis. Besides, I would like to thank my parents and my friend Suchintak Dash for questioning my arguments at every stage and motivating me during this time.

Tampere, October 2020

MOSTAFA TANJIB MOHIUDDIN

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**LIST OF SYMBOLS AND ABBREVIATIONS**

BPR	Business Process Reengineering
CEO	Chief Executive Officer
HRM	Human Resource Management
IS	Information System
IPR	Intellectual Property Rights
KIBS	Knowledge-Intensive Business Services
KM	Knowledge Management
KMS	Knowledge Management System
R&D	Research and Development
SME	Small & Medium Enterprises

# 1. INTRODUCTION

## 1.1 BACKGROUND

The twenty-first century regards as an era of technology (Raja and Nagasubramani, 2018), and also, this is the time when the technology era's evolution into the knowledge era starts (Lambe, 2011). New technologies create a base for innovation (Tully, 2003). Organizations that work with innovation grow faster and earn a high profit (Kleinknecht et al., 1997). According to Cozijnsen et al. (2000) as well as Asplund and Sandin (1999), only one innovation project becomes successful out of five (Van der Panne et al., 2003). Only a single factor couldn't decide the success of innovation; there is a wide range of factors involved with it (Maidique and Zirger, 1984). Innovators feeling for customer needs (Freeman et al., 1972), and innovator's knowledge about the market (Cooper, 1980) are two crucial factors between other factors responsible for the success of the innovation. Therefore, innovators need to have the right knowledge about the market and its customers. Assimilating customer into innovation process not only improve service quality but also help to gain success (Hoyer et al., 2010). Leiponen and Helfat (2010) claim that knowledge from customers affects innovation significantly. In other work, deficiency of knowledge treats as one of the critical barriers for innovation to become successful (Storey and Kelly, 2002). From the beginning of the innovation process, innovators try to hide innovation-related information as much as possible. Due to the nature of their work, they do not have much contact with the users of their innovations. Moreover, innovators feel afraid to share their innovation information from the beginning due to the concern about the protection of their knowledge. Hernandez et al., (2015) as well as Frishammar et al., (2015) address that knowledge holders competitive advantage put in a great danger due to the leakage of his knowledge.

To solve this issue, one of the suitable solutions could be knowledge protection. Knowledge protection considers as a defence mechanism to share knowledge while cooperating with others (Yang et al., 2014). According to Estrada et al. (2016), with a proper knowledge protection mechanism, defining the boundary of knowledge sharing is possible. The strategies of knowledge protection divided into two types by the researchers (De Faria and Sofka, 2010). Whereas they define one type as formal (Harabi, 1995) or legal protection methods (Encaoua et al., 2006) like patents or copyrights (De Faria and Sofka, 2010), another type of strategy is known as market-based (Encaoua et al., 2006) or strategic (Harabi, 1995) or first-mover method (Laursen and Salter, 2005). Formal knowledge protection strategy base on legal rights, whereas strategic knowledge protection strategy base on the informal process (De Faria and Sofka, 2010). A combination of both strategies also become helpful for the innovators for securing their knowledge.

While achieving the success of knowledge protection is not possible without a complete knowledge management system. Ayatollahi and Zeraatkar, (2020) define knowledge management

as an art of transformation which helps an organization to achieve success. Not only organizational performance, according to Friedman and Prusak, (2008) knowledge management also improves individual performance. Okunoye and Karsten (2002) argue that the size and geography of an organization do not affect the possibility to achieve knowledge management success. If any organization wants to acquire insights from its experience, knowledge management helps to do that (Gunjal, 2019). Organizations already acknowledge knowledge management as the most important ‘strategic technology’ (Gunjal, 2019). Organizations need this critical strategy to achieve sustainable competitive benefits which ultimately leads them to their desired success (Halawi et al., 2017). Due to the complexity of the knowledge management system, it needs a strong base of success factors (Okunoye and Karsten, 2002). While considering all the critical success factors for knowledge management, researchers consider different alternative perspectives, different projects, and organizations. Thus, it is very much possible for them to think about further knowledge-related factors while choosing the most crucial success factors. Moreover, there is already a lot of knowledge management success model documented in the literature. It will be interesting to know any of these models considered knowledge protection as a success factor for their model.

There are various types of answers that might arise from these questions; either, researchers can consider the technology and innovation industry or not. If the possible answer is yes, then the answer to the next question will be important. There are two possible answers in this situation also, yes and no. If the answer is no, then the potential value of knowledge protection will be null. But if the answer is yes, then the problem facing by all the innovators may get solved in the future. Then, it will be possible to declare that knowledge protection will help researchers and visionaries to commercialize their innovations more successfully.

## ***1.2 RESEARCH PHILOSOPHY***

A knowledge development system where believes and assumptions are core content refers to research philosophy (Saunders et al., 2009). Research philosophy also considers as a system which turns into some actual knowledge about a research theme from the researcher’s old views (Žukauskas et al., 2018). Žukauskas et al. (2018) consider research philosophy as the foundation of the research because research policy, problem formulation, data collection, process, and investigation include in it. Saunders et al. (2009) urge that research philosophy process not only helps to grow research nature but also accelerate the growth of research assumptions and research knowledge. According to Žukauskas et al. (2018), the authors identify four types of research philosophy till now: realistic, positivist, interpretivist, and pragmatist.

Realistic research philosophy gives more concern on the assumption that are related to human nature perception (Lancaster, 2005). Positivist research philosophy observes the world in an objective mode where researchers work alone and separate themselves from their value. Overall



in this philosophy, researchers consider as an objective analyst (Žukauskas et al., 2018). Interpretivist research philosophy is the opposite of positivist research philosophy where the world observes as a subjective style. Interpretivist research philosophy emphasis the researcher's view of perceiving the world. The researcher's interest is the basis of this philosophy (Žukauskas et al., 2018). Pragmatist research philosophy believes in the current action. For this philosophy, that is the truth, and it considers facts as the ultimate truth (Žukauskas et al., 2018). According to Lancaster (2005), in pragmatist research philosophy, practical results are more critical. This philosophy believes in the freedom of researchers where they can choose any suitable methods or technique according to their research need (Alghamdi and Li, 2013).

A researcher needs to make some assumptions at every step in the research process. These assumptions are ontological assumptions, epistemological assumptions, axiological assumptions (Burrell and Morgan, 2017). Nature of reality related assumptions generally considers as an ontological assumption. In business and management research, it includes organizations, organizational events, management, individual employee's professional life, and artefacts. For an individual, ontology refers to his/her way to see the business and management world and his/her choice on the research topic (Saunders et al., 2009). Epistemological assumptions are mostly related to knowledge. What type of knowledge are legal, valid, and adequate, and how to communicate that knowledge with others is the concern of epistemological assumption (Burrell and Morgan, 2017). Business and management researchers use various types of epistemology like narratives, archival and autobiographical, and fictional literature. The essentiality to recognize the strength and confines of different epistemological assumptions is not possible to ignore because that effect the whole research process (Saunders et al., 2009). Ethics and value are the primary concern of axiological assumptions. One of the critical matters of axiological assumption is to determine the limit of the positive impact of one's worth and ethics on his/her research (Saunders et al., 2009).

This thesis research falls in a mixed category of epistemological assumptions and axiological assumptions. Epistemological assumption concern about legal knowledge and its communication. The main topic of this research is knowledge protection, and the target organizations are technology and R&D organizations. Researchers are concerned with the security of their knowledge, and their apprehension becomes valid because the knowledge they have, or their organization have those legally belong to them. That is why it becomes a concern while they share that knowledge with others. On the other side, somehow, every research connects with axiological assumptions. Personal value and ethics affect every researcher's thoughts and work. The critical matter is to determine the limit of the positive impact on the research that diverges between different person and situation.

### **1.3 RESEARCH QUESTION**

Complete understanding of business and management process and its outcome is one of the primary purposes of business and project research (Saunders et al., 2009). According to them, some research projects aim to understand the effect of organizational policies. In contrast, some seek to understand the operational process, or some aim to compare the process of a different organization. Defining a research question, which can express the research topic is essential before starting the research process (Saunders et al., 2009). They believe that research question importance is high because it is the focus of the research. Different kind of research questions found in the literature; evaluative, descriptive, exploratory, or explanatory are some of them (Saunders et al., 2009). It is essential to refine the research question until it gives a clear about the search and it is also important to exclude unnecessary words from the research question (Clough and Nutbrown, 2012)

In this research, I will try to find out the theoretical background to create an association between the security or protection of knowledge and the knowledge management (KM) success model. For that, the primary aim will be to find out the list of knowledge management factors. So that it will be possible to find out either knowledge protection exists in that list. If knowledge protections get the acknowledgement, then need to find out the role of knowledge protection in the knowledge success model. Therefore, the solution to the problem that identified in the previous chapter will try to figure out answers to the following questions:

- ***What is the role of knowledge protection as a critical success factor in knowledge management success models?***

### **1.4 RESEARCH METHODOLOGY**

Build research on and connect it with existing literature is a complex task (Snyder, 2019). There are some guidelines already exists for literature review, based on which Snyder, (2019) suggests different types of reviews. Integrative review, meta-analysis, systematic, semi-systemic review are some of them. In systematic research, the purpose is to compare evidence. In contrast, semi-systemic research's goal is tracking a topic's development over a period of time and overview of a research area. In integrative research, the purpose is an analysis of an issue (Snyder, 2019). Of course, the research strategy is also different like systematic, non-systemic, and may or may not systematic for systematic, integrative, and semi-systematic research. Whereas systematic research focuses on quantitative articles, semi-systematic research focuses on research articles, and integrative research focuses on books, and other published texts along with research articles (Snyder, 2019). According to him, due to the strict requirements of search strategy and inclusion of articles for review, systematic reviews are not always the best option for research.

Semi-systematic review design is for topics with different concepts, and researchers of various disciplines generally study (Wong et al., 2013). The proposed methodology for this thesis relies on a semi-systematic review. It is because semi-systematic review focuses typically on research articles, and it tracks the development of a topic for a while - Both the stipulation match with the aim of this research. There is no specific standard structure for a semi-systematic review (Ferrari, 2015). The planned methodology for this thesis consists of four steps.

- i) Find out the relevant search word and conduct research,
- ii) Select the right journals and articles,
- iii) Find out the relevant topics,
- iv) Write the paper

- **Find out the relevant search word and conduct a search:** Identify the right search terms is the most crucial matter for the thesis topic (Bell and Waters, 2014). A search term is a primary term, which expresses the research question and research objective accurately, according to Saunders et al. (2009). The search word is important because it outlines the limit of the literature. The right search word helps to select correlated articles and eliminate the nonrelevant articles at the same time (Ferrari, 2015). Therefore, the first step for the semi-systematic review is to find out some impeccable keywords to start the search. Knowledge management is still an emerging field. Thus, the keywords are changing with time, and new words are taking the place of the old words. Security of knowledge/knowledge security has the same meaning as the Protection of knowledge/knowledge protection. But the second one provides more accurate results than the first one. Moreover, that helps to find out more relevant articles connecting with this thesis.

Saunders et al. (2009) state that for an effective literature search, a combination of different searching approaches is helpful. A combination of search online, scan literature available in the university and other libraries, explore different online databases or utilize previous reading experience. Online search is quite widespread and helpful. Saunders et al. (2009) suggest using only online academic sources for the research is not enough. He also states that specialized search engines like Google Scholar are highly effective for searching academic resources, but they need to use sincerely.

- **Review the journals:** Saunders et al., (2009) state journals as a vital source of literature article. Articles generally consider as the literature sources if it officially publishes in journals. Referred academic journals, non-referred journals, professional journals, or trade journals are widely used journals for research (Saunders et al., 2009). Articles published in these types of journals, especially in referred academic journals are written by an expert of that field then evaluate and review by their expert peers. The

language uses in such journals are highly technical or field-specific, contains confirmed information, enclose comprehensive footnote (Saunders et al., 2009). Therefore, the chances are high to get the most recent articles in such journals. There is no doubt that high-ranked journals publish excellent articles, but it is also true that all the articles of the same journal have the same quality level. Also, it does not mean that lower-ranked journals publish articles with less value (Macdonald and Kam, 2007).

Therefore, it is crucial to find out the right journal while searching for the exact articles. Researchers need to rely on their evaluation to find the journals and need to take into consideration of their research question (Saunders et al., 2009). The specialized search engines rank articles based on citation numbers, publication dates, and authors (Saunders et al., 2009). From that list, it is possible to find out the high-ranking journals. Bell and Waters, (2014) suggest considering publication period, literature type, sector, or subject while choosing the right articles and journals for the review.

- **Find out the relevant topics:** Not all the potential articles need to have the information that needs for this thesis research. Therefore, in this step, it is necessary to find out the right information applicable to the study. Reading articles associate with the research topic helps to gain knowledge and clarify the research question, but only exact relevant research articles shape the thesis (Saunders et al., 2009). Research related to the emerging topic needs to review more widely. According to them, reading both recent and old articles not only help to shape the research topic but also help to redefine the search item. The vast amount of search result may distract the author from the main topic, therefore keep a criterion of inclusion and exclusion to assess literature help to prevent such situation (Saunders et al., 2009). Here, the author's aim should be to find out the security of knowledge related information, materials applicable to the Knowledge Management success model concepts.
- **Writing the Thesis:** After completion of the above steps, the main goal will begin, which is writing the thesis based on the search result. The writing will portrait writers' understanding of the topic, along with significant matters and debates on that topic (Denyer and Tranfield, 2009). It will contain not only the background of the thesis and the study of other authors' articles but also includes the justification of the objective of the thesis and provide the answer to the research question (Saunders et al., 2009). The writer of the thesis needs to be careful when using other author's ideas and topic, moreover need to be more conscious while forming his view and assumption. According to Saunders et al. (2009), while creating the view and assumptions, main themes need to be in a logical order and provide new acumens on the research topic.

## **2 KM SUCCESS FACTORS & SUCCESS MODELS**

### ***2.1 DEFINITIONS of BASIC TOPICS***

#### **KNOWLEDGE**

Define a precise definition of knowledge is difficult; according to Davenport and Prusak (1998), a lot of scholars agree on this fact. Often knowledge is considered as organized information or as actionable information (Rowley, 2007). Therefore, knowledge is a chain of interlink information (Hilbert, 2016) or correlational structure. When experience, values, information, and insights mix, then the formation of knowledge transpires. According to Davenport and Prusak (1998), knowledge is a combination of contextual information, principles, experience, and a specialist's vision that develops a framework to assess and integrate new experiences and information. But knowledge will be valuable only when these components help to gain some new advantage for a person or organization. According to Miller et al. (2007) and Nonaka (1994) to develop a sustainable competitive advantage, knowledge is a critical factor (Kumar and Ganesh, 2011). Knowledge is available in documents, audio, video, or ascend from different organization practices, customs, routines, procedures.

Survival in today's competitive era is not possible without knowledge. Knowledge is not only essential for any organization but also a crucial element for achieving competitive advantage. Storey (2005) states organizations consider knowledge as necessary for competition and policy, whereas, Ling et al. (2008) argue that developing a knowledge-based economy is not possible without the ultimate power of knowledge. One's capability to exploit knowledge helps to achieve success in business (Ling et al., 2008). For continuous innovation and make them successful, knowledge is the essential element (Drucker, 1999; Nonaka and Takeuchi, 1995). But the definition of knowledge remains a problem if knowledge considers as a strategic resource for any organization which needs to define a satisfactory operational idea for the professional atmosphere (Ling et al., 2008). Despite the challenges, Anantatmula and Kanungo (2007) claim knowledge as a critical economic resource because, with time, it becomes evident for every organization that they must have accurate knowledge which is in the correct format and useful under all situations.

#### **KNOWLEDGE MANAGEMENT**

Knowledge is a standard topic from the very beginning, but knowledge management came into the scene in the early 1990s (Ling et al., 2008). Knowledge management arises from two basic concepts knowledge assets and knowledge sharing (Koenig and Neveroski, 2008). With time, now, knowledge management is widely used in all types of organizations. Large organizations are using it extensively from before, but nowadays, even medium and small organizations intend to use it to achieve success.

Thus, it is alright to state that knowledge management already recognizes as a necessary managerial process to achieve a competitive advantage (Santoro et al., 2018). Moreover, knowledge management helps the firms to develop innovativeness (Teece, 2007) and attain sustainable business (Argote and Ingram, 2000; Davenport and Prusak, 1998). That is why Darroch (2005) think knowledge management can facilitate an innovation process by recognizing and leveraging knowledge. Lloria (2008) believes knowledge management is a combination of strategic management and innovation in the information and knowledge-creating systems.

Researchers and philosophers provide different types of definitions of knowledge management base on other knowledge notions (Choy and Suk, 2005), where some of the definitions consider the business and technology aspect of knowledge management. Radding (1998) consider knowledge management as a business practice. On the other side, Murray E. Jennex contemplates knowledge management as a decision-making process. According to him, knowledge management is a practice when the experience of previous decision making applies for the present and future decision making with the hope of future betterment of the competence of the organization (Jennex, 2006). Cong and Pandya (2003) state knowledge management as an organization's capability to use its gather knowledge to accomplish the purposes of the organization. Huosong et al. (2003) explain knowledge management as a process to use an organization's knowledge efficiently for generating business prospects and technology.

To manage the knowledge management process efficiently, knowledge creation, sharing that knowledge, storage of knowledge, and application need to consider entirely. According to Lee and Choi (2003), knowledge management consists knowledge process along with infrastructures, management activities and competencies, where the latter three help to improve the knowledge process. Here, knowledge processes include knowledge creation, knowledge share, acquisition and transfer of knowledge and application. Therefore, it can quickly state that the range of knowledge management is enormous and widespread that it is almost impossible to consider all the factors of knowledge management in a single definition. Despite this difficulty, the author tries to define knowledge management. Knowledge management is a process where knowledge creates from previous experience, store in a system, share with stakeholders, and protect from exploitation, which helps the organization to take the right decision at the right time to generate more business and achieve organizational goals.

## **KNOWLEDGE PROTECTION**

The success of research & development and innovation depends on the knowledge and resources, more specifically, how knowledge creates and shares inside and outside of the organization. Crossan et al. (1999) define knowledge sharing as the transfer of knowledge between organizations, divisions, groups, teams, or entities. Knowledge sharing not only helps in

knowledge application and innovation but also helps to achieve competitive advantage (Wang and Noe, 2010). Knowledge sharing occurs through some different processes like written conforming, face to face networking, documenting knowledge (Cummings, 2004). Because of the high pace of technical change and diversification of knowledge assets, collaboration with other companies or individuals become more important for the firms. This type of association also creates problems like knowledge spillover, and that tends towards the firm from achieving full commercial benefit from its innovation.

Due to the advantages achieved from knowledge sharing, the concept of knowledge protection arises. Thalmann and Ilvonen (2020) agree that organizations are giving more consideration to knowledge protection due to the competitive advantage to achieve from knowledge. An organization's official practices and an individual's informal practices to avoid knowledge loss, spillover, or undesirable disclosures define as knowledge protection (Thalmann and Ilvonen, 2018). Legal protection like contracts, patents, copyright, trade secret helps a firm to protect its knowledge (Gast et al., 2019). Also, informal mechanisms like human resource management (HRM), tacit type of knowledge play a vital role to protect knowledge (Hurmelinna-Laukkanen, 2011). The strength of protections allows firms to make more profit from their innovations (Hurmelinna-Laukkanen, 2011). IPR and HRM practices help the firms to enable safe knowledge transfer. Too much focus on risks and threats associated with the conversation of knowledge and extensive worry about replication lead an organization to ignore opportunities (Hurmelinna-Laukkanen, 2011). That also tends towards the ignorance user's expectations.

Bolisani et al., (2013) said that literature gives more concentration on formal knowledge protection like intellectual protection rights arrangements and patenting of large firms. Little attention provides to small firms or service companies or knowledge-intensive business services (KIBS). According to Päällysaho and Kuusisto, (2008), based on legal formality, it is possible to divide knowledge protection into three types. The first one is formal protection, next one is semi-formal protection, and the last one is informal protection. Formal protections are usually known as intellectual property rights (IPR) which are legally effective (Päällysaho and Kuusisto, 2008). Copyrights and industrial property rights like trademarks, patents, design rights or utility models, combinedly acknowledge as IPR. Semiformal protections are also legal but without any registration. Contracts, non-disclosure agreements, non-competition agreements also protect knowledge, and violation of such agreements is punishable (Päällysaho and Kuusisto, 2008). Both authors also argue that despite the availability of different formal and semi-formal arrangements for knowledge protection, most organization protect their knowledge with informal procedures. Secrecy, documentation, management, restricted access to information, fast innovation cycle, technical security, are some of the standard informal processes of knowledge protection (Bolisani et al., 2013). A figure of the knowledge protection methods is given below:

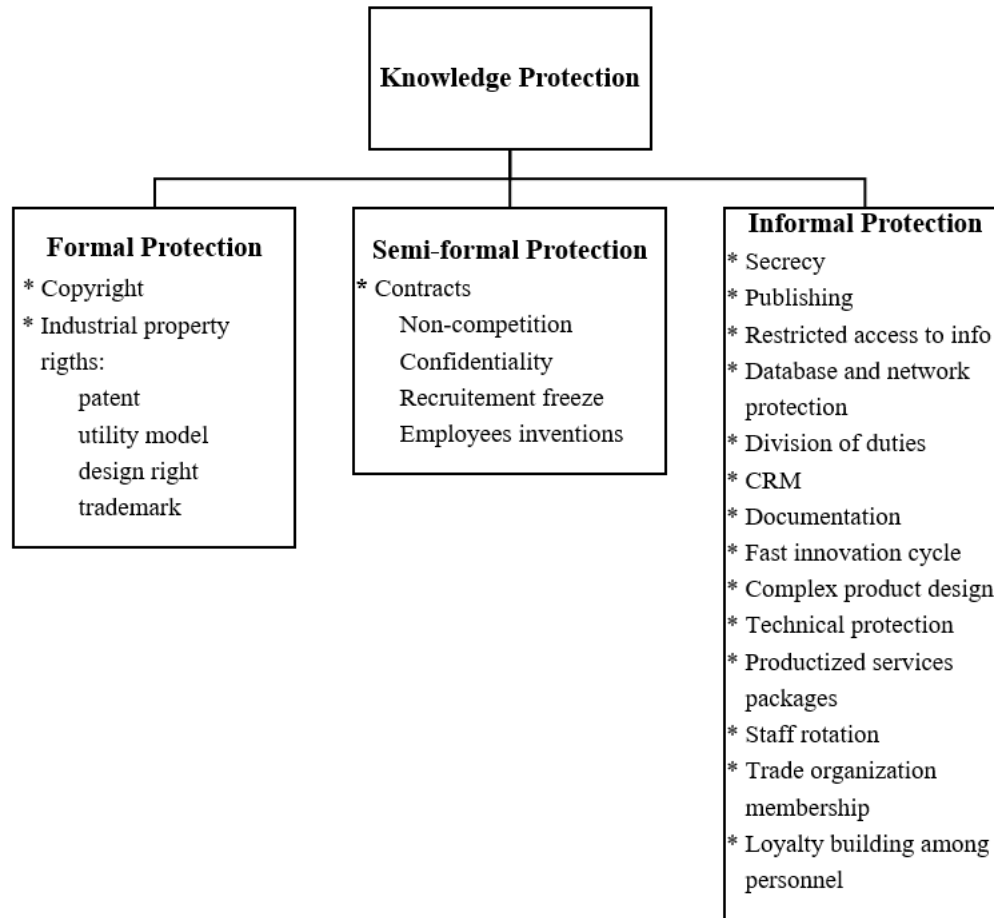


Figure 1: Knowledge protection methods (adapted and modified from (Bolisani et al., 2013))

## 2.2 KNOWLEDGE MANAGEMENT MODELS

When researchers are trying to find out successful knowledge management, they realize that the research in this area is not widely done (Massey et al., 2002). Therefore, they start working on the development of knowledge management success models. Before this realization, only William H. DeLone and Ephraim R. McLean propose an information system success theory with six major dimensions in 1992, based on a large number of studies. Roland Maier project a new model for the success of a knowledge management system in his book 'knowledge management systems' in 2002 and the base of his success model is (DeLone and McLean, 1992) I/S success model. Massey, Montoya-Weiss, and Driscoll propose a knowledge management success model in 2002 while they are studying the insights of a technology company called Nortel Networks. Keith Lindsey derives a knowledge management effectiveness theory in 2002, which is a combination of two theories proposed by Gold et al. (2001) and Becerra-Fernandez & Sabherwal, (2001).



Here, in this thesis, the author tries to find out the knowledge management success models which are more focused on technology, research and development, and engineering fields. Researchers of each model mentioned in their original work in which organizations they considered during their study to develop a knowledge management success model. After an extensive investigation, the list of the organization considered by each knowledge management success models given in table 1 below.

Table 1: List of organizations considered by the KM success models

Model	Considered Organizations
DeLone and McLean IS Success Model	Bank Computer vendor organization Financial firms Firms Military Oil companies R & D organization Small manufacturing firms Software development firms University
Maier KMS Success Model	Focused all type of organizations
Lindsey KM Effectiveness Model	Focused all type of organizations
Massey, Montoya-Weiss, and Driscoll KM Success Model	Technology company
Jennex and Olfman KM Success Model	Engineering organization

### **DeLone and McLean IS Success Model**

Based on an immense study, Willian H. DeLone and Ephraim R. McLean propose an information system success theory with six major dimensions in 1992. They use these dimensions for conceptual and empirical studies by reviewing 180 articles. DeLone and McLean suggest their model by modifying Mason's (1978) adoption of communication theory. In his adoption of communication theory, Mason recommends some success factors at every information level. The success model created by DeLone and McLean presents in the below Figure 2.

After reviewing different approaches of various researchers, the authors observe that there is a long list of factors that control information system success, and none of the factors is better than others. They also detect that with the progress of time, more researchers are doing more studies on the success factors which significantly reduced the number of success factors and helped to find more accurate success factors. According to DeLone and McLean, researchers are concern less about the overall performance of the organizations. It is because of the difficulty of separate the effect of information systems from other factors of organizational performance. Finally, they urge

MIS success is a multi-dimensional matter, and it is not wise to try to measure success by a single factor (DeLone and McLean, 1992).

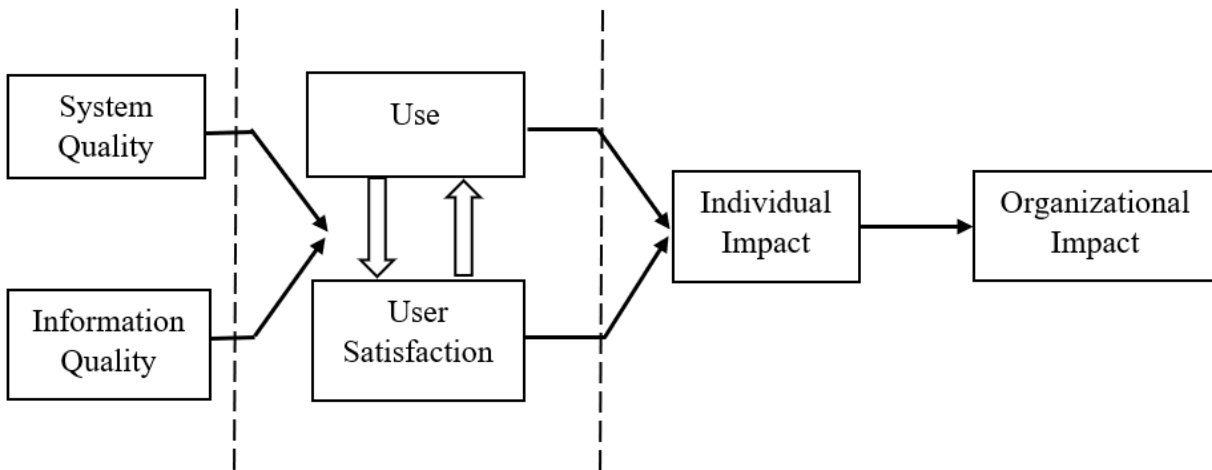


Figure 2: DeLone and McLean IS Success Model (Adopted and modified from DeLone and McLean, 1992)

The theoretical base of measurement of the I/S success model comes from the concept of process and ecology in the effective organizational literature. Six I/S success factors system quality, information quality, use, user satisfaction, individual impact, and organizational impact arranged as an inter-reliant factor so that they distinguish success as a process. While doing it, the factors are arranged according to their impact and maintaining their serial. System quality and informational quality affects the use and user satisfaction individually and jointly. Similarly, use and user satisfaction have internal effects. They affect each other positively and negatively, and the volume of use influences the level of user satisfaction. Next, use and user satisfaction affect individual satisfaction, and individual satisfaction directly impacts on organizational satisfaction (DeLone and McLean, 1992).

The proposed I/S model tries to reproduce of I/S success progression and the factors related to that process. The authors propose further study and development to prove the validation of the model.

### Jennex and Olfman KM Success Model

After studying engineering organizations for five years, Murray Jennex and Lorne Olfman propose a model which influence the success of knowledge. Murray E. Jennex and Lorne Olfman include technical resources, level and form of knowledge management system in their model, replace ‘use’ to ‘intend to use or perceived benefit’ a knowledge management system, and renamed information quality into knowledge quality. The model is presented below in Figure 3.

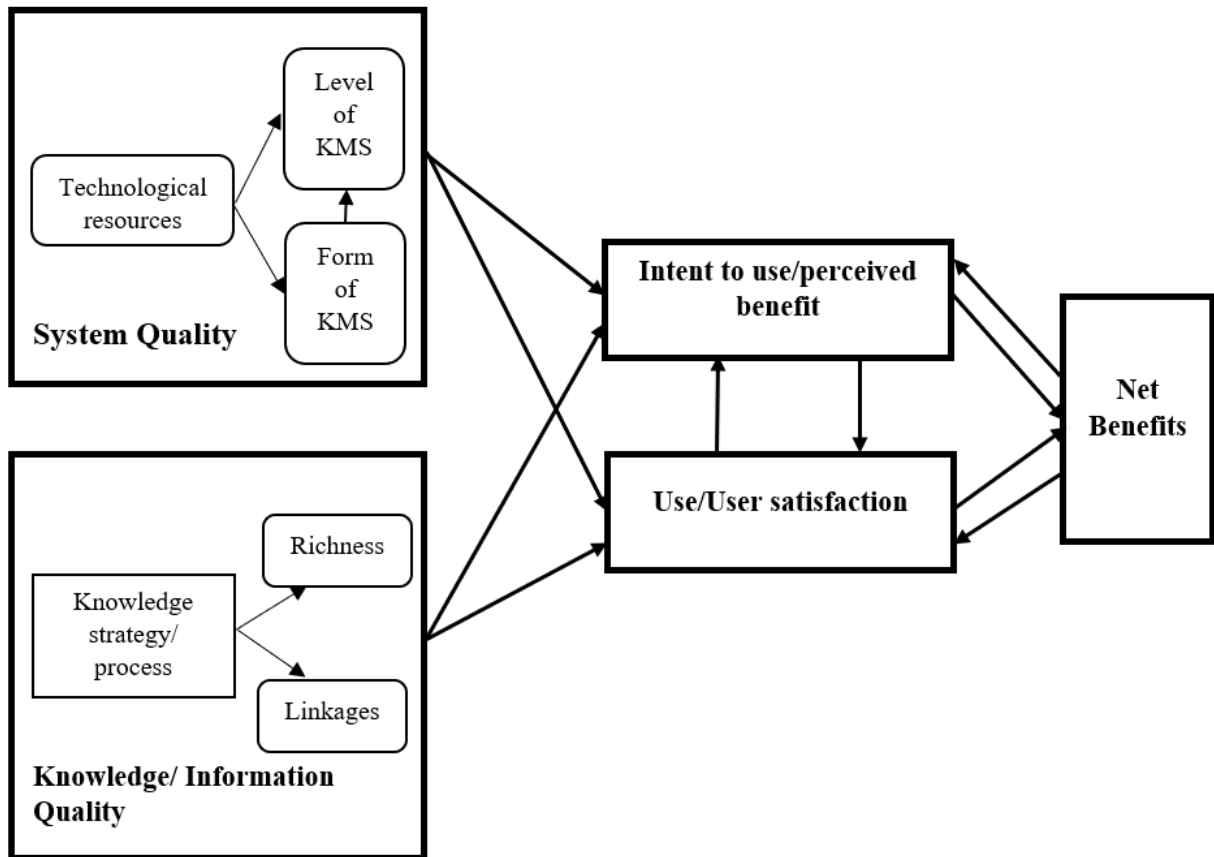


Figure 3: Jennex and Olfman KM Success Model (Adopted and modified from (Jennex and Olfman, 2003)).

### System Quality

Knowledge management systems performance on i) knowledge creation, storage of that knowledge, transfer of knowledge and application, ii) organization management's automation and codification, and iii) support from information system's resources and infrastructure - how well knowledge management system processes these three functions define system quality. System quality has three independent concepts technical resources, level of the knowledge management system, the form of the knowledge management system. Development, operation, and maintenance capability of a knowledge management system can define by technological resources. Knowledge management system's structure generally describes by the computerization and integration of knowledge management and organizational management. Knowledge management system's level defines by the ability of a knowledge management system to search, retrieve, and implementation of its functions. Form of the knowledge management system and technical resources influence on knowledge management system level (Jennex and Olfman, 2003).

### **Knowledge/ Information Quality**

Knowledge/ information quality confirms the capture of the right contextual knowledge and availability of that knowledge for the right users at the right time. Maintenance of the quality of the knowledge depends on three elements, i.e. the process or strategy of knowledge, the richness of knowledge, and the linkage between components of knowledge. Knowledge strategy/ process is an independent construct, and the other two are a dependent construct (Jennex and Olfman, 2003).

Knowledge strategy/ process focuses on the organizational approach to find knowledge users, identify knowledge for capture and reuse, process development, format, and context of knowledge before storing in the system. The exactness of the knowledge along with its timeliness refers as knowledge richness. It also shows concern about the context of captured knowledge. The linkage between knowledge components refers to the availability of expert resources in an organization and the knowledge maps (Jennex and Olfman, 2003).

### **Use/User satisfaction**

The actual utilization of knowledge management system output and knowledge management system user's gratification defines as the construct use/user satisfaction. These constructs also use as the success measure for a knowledge management system (Jennex and Olfman, 2003).

### **Intent to use/perceived benefit**

Users' intention to use any system is an excellent way to measure the future of that system. Thus, the perceived benefit can define as the perception of the benefit of a system by its users. Knowledge management system's usage is still voluntary, and its efficiency and success depend on the intention of the users to use it in the future (Jennex and Olfman, 2003).

### **Net Benefit**

It is challenging to combine all impacts to calculate the net benefit from the knowledge management system. Improvement of individual resource performance due to the use of a knowledge management system affects the net benefit. This improvement is also an indication of the benefits that the system provides to its users. These benefits include a better understanding of specific issues, improvement in decision making, alteration in user daily activity, or modification in the thought process of senior management about the system (Jennex and Olfman, 2003).

### **Maier KMS Success Model**

Roland Maier projects a new model for the success of a knowledge management system in his book 'knowledge management systems' in 2002. DeLone and McLean I/S success model is the base of this new model. Maier adds some additional criteria to assure knowledge management system's success.

The model has three levels. Level 1 is called system and service, level 2 is called use, and level 3 is called impact. This division of levels inspired by Ballantine et al. (1998) 3-D model. The first level focus on the system quality, knowledge quality, and knowledge-specific service. Knowledge specific service is the new element that inserts at this level, and information quality replaces by knowledge quality. The second level emphasis the same as its original model, system use and user satisfaction. The third level focus on the effect of system's use on different aspect like impact on individual and impact on collectives of people. Maier added an effect on the collectives of people with the implications for individuals at this level. At this point, the discussion will only focus only on three factors that are newly added or modified. Maier's (2002) knowledge management success model is present in Figure 4.

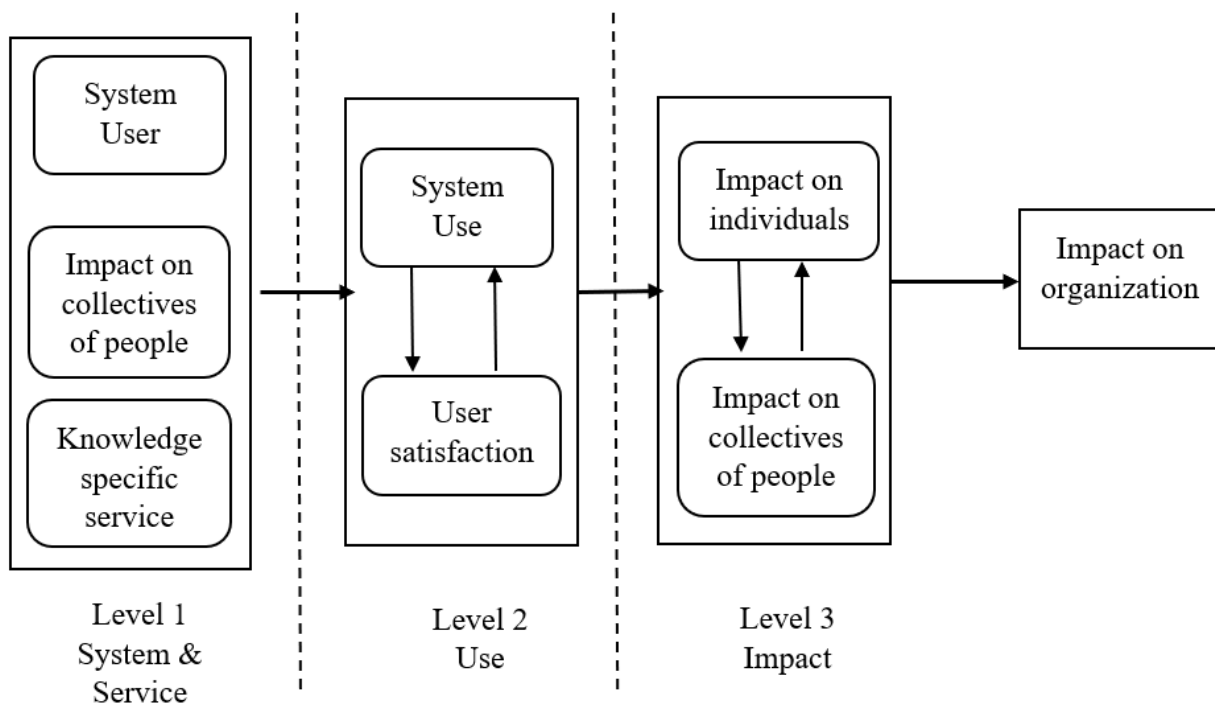


Figure 4: Knowledge management systems success model (adopted and modified from Maier (2002)).

### Knowledge Quality:

The knowledge management system is different from the information system because of the knowledge context. Therefore, information quality replaces knowledge quality in this model. Moreover, information quality and knowledge quality are a part of communication quality. As information and communication are two different ways of seeing the same thing, and the same thing is knowledge quality (Maier, 2005).

### **Knowledge Specific Service:**

Researchers claim that the determination of the success of knowledge management depends heavily on an influential factor is service quality. Therefore, service quality relates to the customer perspective of the organization. With a proper knowledge specific service to satisfy customer's requirements, an organization can improve its customer service and achieve its financial and organizational goals. Dependability, user-friendliness, competence, the credibility of information system personnel measure by service quality. Therefore, knowledge-specific service includes in the model (Maier, 2005).

### **Impact on collectives of people:**

For the development, assessment, share, and use of knowledge, the collective of people are one of the significant units of any organization. Besides different teams and workgroups, communities or other social groups are also a considerable focus of knowledge management initiatives (Maier, 2005).

Maier (2005) states that for a complete and steady assessment of the knowledge management system, a lot of factors need to take into account which has impacts on the success of the system. Goals, design of the organizations, organizational culture, business atmosphere knowledge management instruments are some of the factors besides the characteristics of the participants in the knowledge management process. At the same time, he also admits that he only considers the direct factors while developing the model, and for this reason, most of the variable factors get neglected (Maier, 2005).

### **Lindsey KM Effectiveness Model**

Keith Lindsey derives the theory in 2002 for knowledge management effectiveness. This theory is a combination of two theories propose by Gold et al. (2001) and Becerra-Fernandez & Sabherwal, (2001). Lindsey wishes to use a balanced scorecard approach to measure knowledge management effectiveness. Gold et al. (2001) propose organizational effectiveness theory where they focus on two specific capabilities; i.e. knowledge infrastructure capability and knowledge process capability. On the other side, Becerra-Fernandez & Sabherwal (2001) develop their theory on knowledge management processes and knowledge management satisfaction. Both theories assume that it is possible to achieve benefit for an organization by knowledge acquisition, storage, and transfer. This means knowledge integration can consider as a part of an organization's capabilities (Lindsey, 2002). The theory is given in figure 5.

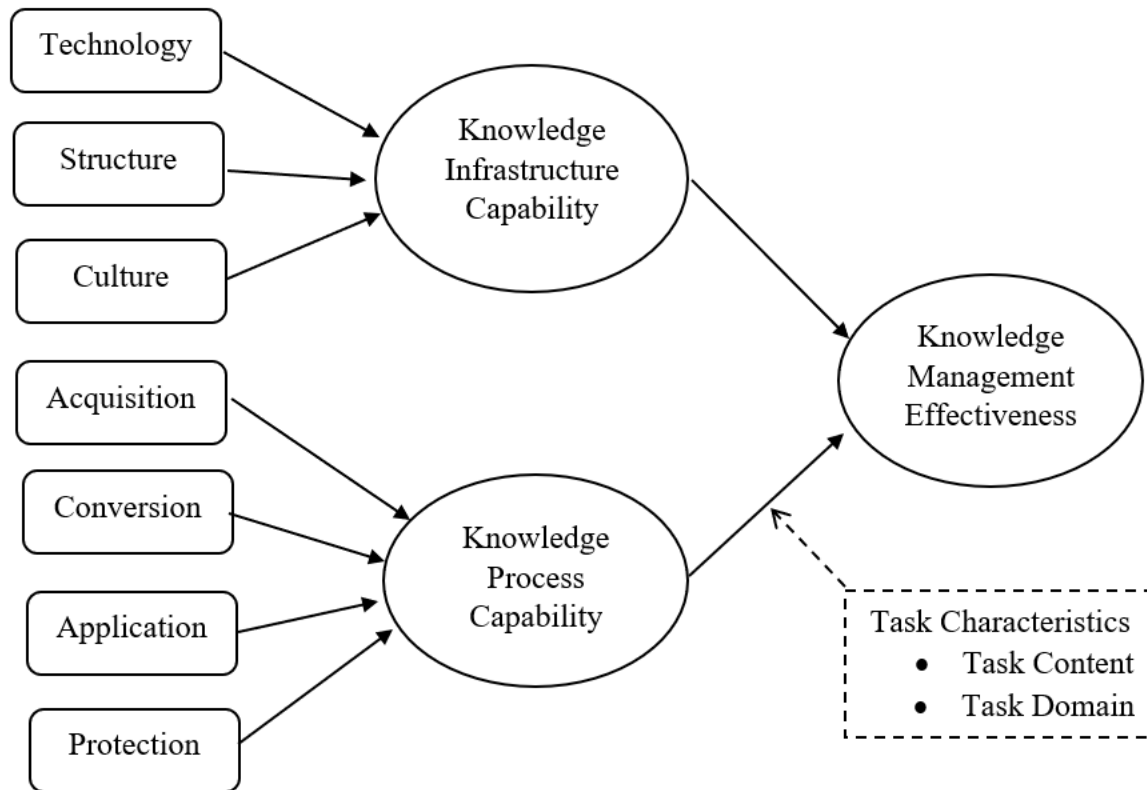


Figure 5: Combined Theory (adopted and modified from (Lindsey, 2002)).

Gold et al. (2001) focus on the organizational structures which they assumed critical for knowledge processes. These processes contain recognize, create, transform, and distribute knowledge. They combine two independent fundamental notions called social capital and knowledge integration. The social capital concept distinguished the importance of relationship network in a social context. In a knowledge management context, a relationship network exists where collective knowledge preserves. Gold et al. (2001) identify social capital as potential and actual resources. These resources entrench together and act as a social unit. On the other side, knowledge integration is the combination of different knowledge activities. Knowledge creation, utilization of knowledge, knowledge experiment, knowledge exploit, assemble of knowledge, knowledge capture, knowledge acquire, knowledge transfer, the collaboration of knowledge, integration of knowledge are some activities defined by the researchers as knowledge activities (Lindsey, 2002).

In this theory, social capital, knowledge integration, and knowledge management success represent as knowledge infrastructure capability, knowledge process capability, and organizational effectiveness accordingly. Technology, structure, and culture are three sub-dimensions of knowledge infrastructure capability. These dimensions provide network, relationship, and shared context, respectively. Acquisition, conversion, application, and protection are four dimensions of knowledge process capability. With these minimum four dimensions, the whole knowledge

process can cover. Between these four dimensions, the only protection is such a dimension that studied less than others. But this fact doesn't decrease its significance at all (Lindsey, 2002).

Becerra-Fernandez & Sabherwal propose their straightforward contingency perspective theory in 2001 (Lindsey, 2002). According to them, the usage of own knowledge determines the success of a knowledge management process. The theory derives from two fundamental concepts of knowledge sharing and task features. The result of the combine these two concepts is knowledge management satisfaction. Their proposed theory suggests the connection between knowledge management satisfaction and knowledge sharing. This connection works by the organizational units performed tasks (Lindsey, 2002).

Task characteristics is a two-dimensional matrix with task orientation and task domain of an organizational unit. Some task-oriented units are process-based (know-how), and some are content-based (know-what). Process-based tasks combine with more tacit knowledge and share knowledge through socialization and internalization mode of knowledge sharing. Content-based tasks are more explicit knowledge related and share through externalization and combination. The task domain generally describes the task of a unit of an organization. Some units focus on a low variety of tasks and some focus on a wide variety. Units that concentrated on a low variety deal with individual knowledge more and shared them through internalization and externalization mode of knowledge sharing. Broad variety units required collective knowledge and shared them through combination and socialization mode (Lindsey, 2002).

As mentioned before, the outcome of the theory is knowledge management satisfaction. But due to provide less attention in the user acceptance and satisfaction part, the theory misses the mark to make a pace with the knowledge management field (Lindsey, 2002).

### **Massey, Montoya-Weiss, and Driscoll KM Success Model**

After broad research on the insights of a technology company called Nortel Networks, Massey, Montoya-Weiss, and Driscoll propose a knowledge management success model. The study suggests that a process-based method assists an organization in recognizing the effect of knowledge management during its performance enhancement. Massey et al. (2002) success model derives from Holsapple and Joshi's (2001) framework.

The company changes its business focus from a technology-based company to a customer or opportunity-based company in a span of six years from 1994 to 2000. During this transition process, they change their new product development process, which is an expert employee-oriented and massive knowledge base intensive work. The knowledge management success model develops with the analysis of the knowledge management strategy of the company and its impact on the resource, environment, and technology. The knowledge management strategy considers internal factors like core competencies along with external factors like competition in the market and customers' requirements. They consider factors like the managerial, resource, and



environmental as the critical success factors that influence knowledge management success significantly (Massey et al., 2002). The components of the model are shown below in Figure 6.

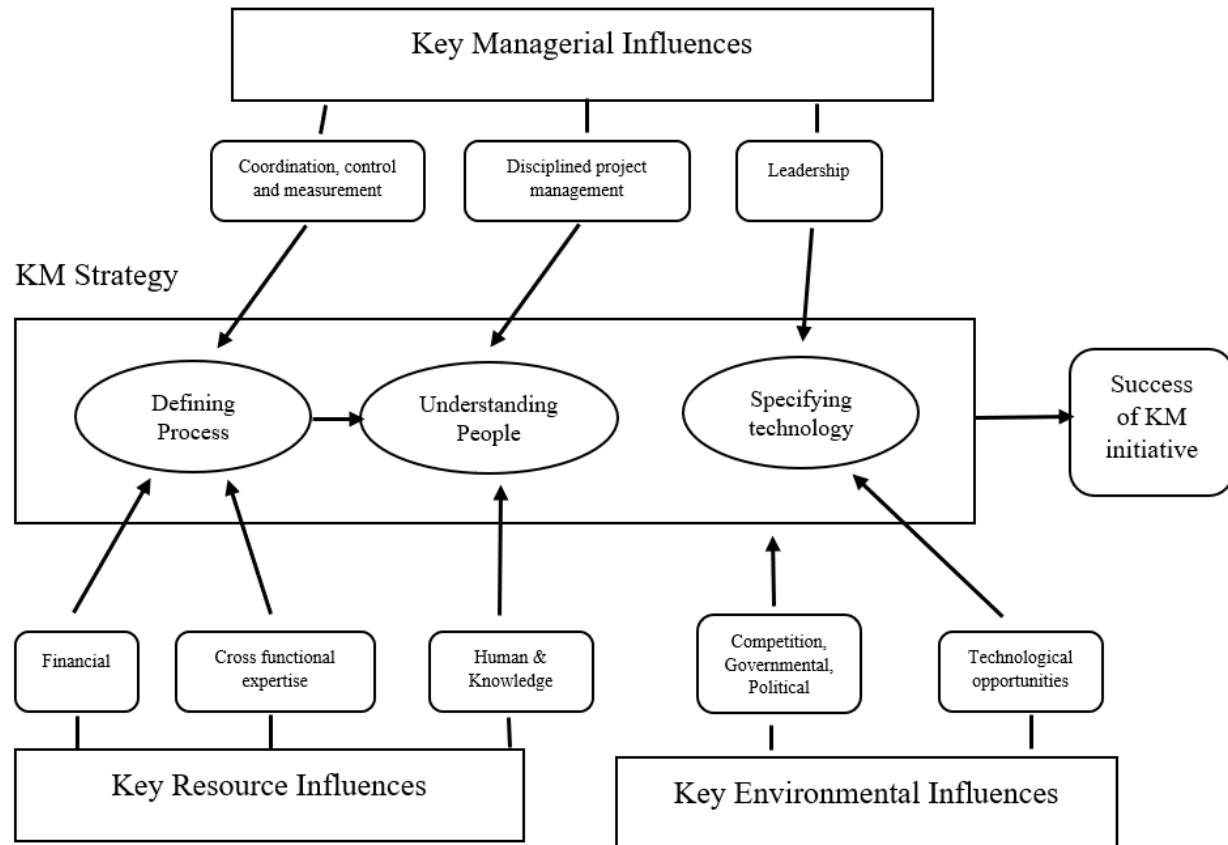


Figure 6: Massey, Montoya-Weiss, and Driscoll KM Success Model

### Managerial Influences:

Leadership, coordination, control, and measurement are three elements which affect managerial influences. Leadership is not only crucial for the abundance of commitment from the top management but also to ensure that the alignment of knowledge management strategy with the business strategy of the organization. Coordination, control, and measurement are a part of the process. Knowledge needs to consider as a process flow. Knowledge can create in any part of the organization and flow across the organization. Here, coordination meaning the management of knowledge flow within the organization. Simultaneously, control authenticates all the actions of knowledge in the Process. The last aspect that influence managerial factor is measurement. On one side, measurement is essential to evaluate the outcome of knowledge management initiatives, leadership, coordination, and control. On the other side, disciplined project management requires to drive the project in the correct direction. It is preferable to define the project scope along with

cost estimation and launch date from the beginning. It is essential because resource allocation is done based on the scope of the project.

#### **Resource influences:**

Financial, human, and knowledge resources are essential to achieve knowledge management success. To complete a project, it is important to have sufficient capital and investment. Supporting with enough financial resources is a sign of trust from the top management. Human and knowledge resources consider the people who have a direct link with the success of knowledge management.

#### **Environmental influences:**

Environmental influences consider as external influences on knowledge management success. Customers, competition in the market, regulatory guidelines, change in technology are some factors that have significance in environmental impacts. Successful knowledge management can increase the financial strength and market growth of an organization. And to achieve this, it is crucial to understand the process and people acutely. This understanding will help to know which technology the organization needs to use to accomplish the goal.

### ***2.3 KNOWLEDGE MANAGEMENT SUCCESS FACTORS***

Knowledge management has significant importance to achieve success or failure in business (Theriou et al., 2011; Witherspoon et al., 2013). Jennex and Olfman describe KM success as a multidimensional concept based on capturing the accurate knowledge to the exact user and using this knowledge to improve organizational and individual performance (Jennex et al., 2016). Alazmi and Zairi, (2003) define critical success factors as limited areas, and success in those areas is essential to achieve competitive advantage. Several critical factors influence knowledge management success (Butler et al., 2007; Quaddus and Xu, 2005). Rockart (1979) defines essential factors for success as “topics in which acceptable results observe and confirm competitive advantage for the organizations.” A comprehensive variety of factors accessible in the literature (Wong, 2005). But not all the factors similarly influence knowledge management. Hasanali (2002) argues it is possible to control some of these factors and some factors are not manageable. Theriou et al., (2011), identify a wide range of success factors in the literature which is responsible for knowledge management success. According to their research, one of the earliest studies conducted on knowledge management success factors in 1996. After that, in the last two and a half decades, many researchers work in different fields and industries to find KMSFs.

Andersen and APQC (1996) propose technology, leadership, organizational culture, and measurement as critical success factors for knowledge management (Theriou et al., 2011). In 1997, David Skyrme and Debra Amidon acknowledged some success factors like knowledge leadership, well-developed technology infrastructure, knowledge-creating and sharing culture, compelling vision and architecture, strong links to a business imperative, continuous learning systematic and

organizational knowledge processes (Skyrme and Amidon, 1997). In the same year, a different approach carries out by other researchers. Holsapple and Joshi, (1997) identify resource influences, managerial influences, and environmental influences and Earl (1997) recognize people, information technology, and corporate culture as success factors.

Davenport and Prusak (1998) suggest a more extensive list of knowledge management success factors. After studying thirty-one knowledge management projects in twenty-four companies, they distinguish few the factors which have a more significant impact on knowledge management success. Technical and organizational infrastructure, linking KM to senior management support, knowledge-friendly culture, economic performance or industry value, standard and flexible knowledge structure, clear purpose and language, multiple channels for knowledge transfer, change in motivational practices are some of them. In the same year when Rudy Ruggles also try to identify the knowledge management success factors, he provides more focus on people than process and technology respectively (Ruggles, 1998).

Next year, other authors find more diversifying knowledge management success factors. According to Arthur Anderson Business Consulting (1999), the most significant three enablers of knowledge management implementation are people, corporate culture, and information technology. On the other side, Liebowitz (1999) recommend knowledge management strategy with support from senior management, a chief knowledge officer (CKO) or equivalent, knowledge management infrastructure, knowledge management systems and tools, knowledge ontologies and repositories, incentives to encourage knowledge sharing and supportive culture as critical factors for knowledge management success. Moreover, APQC (1999) specifies technology, leadership, measurement and organizational culture as knowledge management success factors (Theriou et al., 2011).

Stankosky and Baldanza, (2000) recognize technology, organization, learning and leadership as key ingredients of knowledge management success factors. Choi (2000) uses multiple research methods to discover the most effective success factors for knowledge management. After completing his research, he suggests factors like information systems infrastructure, fewer organizational constraints and top management leadership/commitment as the most significant factors. Holsapple and Joshi (2000) take a completely different approach and use the Delphi study to develop the framework. With that framework, they assess the appropriateness of the factors which they evaluate and explore. According to their framework, the factors organize into three groups, i.e. managerial, resource, and environmental - each category containing different factors. Leadership, measurement, control, and coordination are the four main factors of managerial influence. Andrew et al. (2001) suggest seven critical success factors. They concentrate more on the different aspects of knowledge. Knowledge obtainers, knowledge application, knowledge transfer, knowledge protection, information technology, corporate culture, organizational structure are the critical success factor according to them (Theriou et al., 2011).

According to Hasanali (2002), knowledge management success is subject to several factors. He urges that some of these influencers are controllable, some are not. Information technology infrastructure, measurement, leadership, roles and responsibilities, culture and structure are the five major factors that are critical for the success of knowledge management. A four-pillar model again creates by Bixler, (2002) after Stankosky and Baldanza, (2000) which proves the importance of different factors in knowledge management. Technology, leadership, learning, and organization are those four pillars. Davenport and Probst (2002) present different thoughts on knowledge management success factors. They identify knowledge sharing, knowledge acquisition, organizational policy, benchmarking and training as success factors for knowledge management along with leadership, performance measurement, and information-systems structure.

The result of a survey of 100 companies shows that the management of knowledge is a trendy topic among company management (Chourides et al., 2003). Authors acknowledge that knowledge management can be approached from various perspectives and considering a few of those approaches they identify the information technology, human resource management, strategy, quality and total quality management. This is the first time when marketing acknowledges as a success factor in knowledge management literature. The role of user commitment and motivation in knowledge management systems identify by Malhotra and Galletta, (2003) after detailed survey conduct by them in a healthcare organization. Moffett et al. (2003) try to build a conceptual model for knowledge management, and for that, they do an exhaustive analysis of the literature. Based on that investigation, they suggest, macro-environment, organizational culture, people, and technology as the main elements of knowledge management.

Wong (2005) tries to establish a bridge between the gaps created while investigating the critical success factors. According to him, the critical success factors identified by that time only consider large organizations, and he tries to find out the factors for Small and Medium Enterprises (SMEs). Thus he proposes eleven critical success factors that SMEs should consider while adopting knowledge management. Information technology, management leadership and support, measurement, strategy and purpose, resources, culture, organizational infrastructure, processes and activities, training and education, motivational aids, and HRM are the factors that are important according to him. To validate the proposed critical success factors by Wong (2005), Wong and Aspinwall (2005) conduct a postal survey. Their survey turns out valid and based on the result; they prioritize the critical success factors. Their list appears like this management leadership and support, resources, training and education, culture, processes and activities, strategy and purpose, human resource management, organizational infrastructure, motivational aids, information technology, and measurement. Choy and Suk, (2005) posit a list of success factors to help the researchers to understand more on how to make a knowledge management program successful. They suggest top management leadership and commitment, organizational constraint, employee training, employee involvement, employee empowerment, teamwork, performance measurement,

egalitarian culture, benchmarking, information system infrastructure, and knowledge structure as critical factors to the success of a knowledge-based organization.

Murray Jennex and Lorne Olfman analyze different researcher's papers to identify success factors. They rephrase twelve success factors and rank them based on the citation number. According to them the success factors are knowledge management strategy that identifies users, sources, processes, storage strategy, knowledge and links to knowledge for the KMS, motivation and commitment of users including incentives and training, integrated technical infrastructure including networks, databases/repositories, computers, software, KMS experts, an organizational culture and structure that supports learning and the sharing and use of knowledge, a standard enterprise-wide knowledge structure that is clearly articulated and easily understood, senior management support including allocation of resources, leadership, and providing training, learning organization, there is a clear goal and purpose for the KMS, measures are established to assess the impacts of the KMS and the use of knowledge as well as verifying that the right knowledge is being captured, the search, retrieval, and visualization functions of the KMS support easy knowledge use, work processes are designed that incorporate knowledge capture and use and security/protection of knowledge are the success factors if any organization want to build a successful knowledge management (Jennex and Olfman, 2005).

Akhavan et al. (2006) study the knowledge management practices of six renowned organizations by a qualitative case study technique. Based on the study, they suggest a catalogue of sixteen critical success factors for knowledge management systems. All six organizations consider not all 16 factors. Only organizational culture is the single factor that feels like a success factor by all of them. Training programs, knowledge sharing, organizational structure, knowledge storage are a few factors that acknowledge by most organizations. Knowledge architecture, the network of experts, knowledge strategy, trust, knowledge capture, and support and commitment of CEO are those factors that agree as success factors by a few organizations. They identify a few for factors like transparency, business process reengineering (BPR), knowledge identification, knowledge audit, pilot, but those factors do not acknowledge by most of the organizations.

Conley and Zheng, (2009) try to find out organizational factors influence knowledge management effectiveness. They propose a framework that consists of organizational contextual factors. These factors divide into organizational factors and knowledge management initiatives factors. Top Management and leadership support, organizational culture, corporate and business strategy, organizational structure select as organizational factors and processes, technology infrastructure, training and education, measurements to calculate targets, goals and improvement, incentives, dedicated knowledge management team state as knowledge management initiative factors.

Lehner and Haas (2010) examine critical success factors in different dimensions. According to them, these dimensions are human beings, organizations, and technology. They segregate all the

factors into these three dimensions. Factors like top management and personality place under the 'human being' dimension as this dimension considered the individual attitude of the members of the organizations, whereas the factors which are functioned and planned by the organization itself position under the organization dimension. The process of knowledge management, personnel development, delegation/participation, meta-communication of knowledge management, staff member motivation, goal system of knowledge management, knowledge encouraging corporate culture and social nets/ relationship are the factors that consider under the organization dimension. The third dimension is technical and application system, system, KMS-content are the factors that come under it.

Sedighi and Zand (2012) divide the critical success factors from two perspectives as external factors and internal factors. Again internal (organizational) and external (environmental) factors are divided into sub-factors based on the influence they have on knowledge management success. Sub factors of internal (organizational) perspectives are the structure, procedures and culture, technology and infrastructure, human & financial resources, knowledge management processes, strategy and leadership.

Samad et al., (2014) define organizational culture, information system infrastructure, leadership and employee training as the critical factors for the success of knowledge management. Shrafat (2018) collects samples from 247 respondents to identify factors that influence KMS adaption. The result shows that IT capabilities, knowledge sharing, knowledge management capabilities, and organizational learning have a significant impact on KMS adaption.

After reading and analyzing all the above literature, the author finds out thirty-three critical success factors for knowledge management. At this point, it is essential to create a ranking of them, depending on the number of citations they have in the literature. If the numbers of the citation are the same, then knowledge-related factors get priorities over others. Even after that if the citation number and subject of the factors are the same, then the most recent citation gets importance over the old one. Such as fourteen factors have only one citation. Therefore, they locate in the last part of the table. Among these fourteen factors, five factors are knowledge-related, a single factor is knowledge management system related, four factors are organization related, and four factors are employee-related. Because the criteria state knowledge-related factors will get priority over others, therefore knowledge related factors placed first then knowledge management system-related factors. The rest of the eight factors position later. Between the five knowledge-related factors, the one with the latest citation gets priority. For example, knowledge storage and knowledge capture both the factors get cited in 2006, and knowledge obtainers and knowledge transfer mentioned in 2005, therefore, knowledge storage and knowledge capture position first between the fourteen factors. Moreover, knowledge storage and knowledge capture both cite in the same year, but knowledge storage gets more important in the original article, so it places before knowledge capture.

Moreover, sometimes the same factor describes differently by different authors. The core concept of the factor is the same, but they label the factor with an alternative name. Earl (1997) shows corporate culture as a critical factor. Andrew et al. (2001) and Lehner & Hass (2010) also mention corporate culture in their respective articles. On the other side, Conley & Zheng (2009), Akhavan et al. (2006), Moffett et al. (2003), Liebowitz (1999), and others state the same concept as organizational culture. The same situation observes for other factors like technology infrastructure/ application system/ information technology or top management/ support and commitment of CEO/ top management and leadership support/ management leadership and support/ leadership, or network of experts/ dedicated KM team/ delegation/ participation/ resources/ people, or knowledge strategy/ goal system of knowledge management/ KM/ strategy and purpose/strategy and others. Therefore, a need for uniformity arises while outlining the list of success factors. Based on the reading of each article, the author decides one suitable title between different titles which covers the whole concept of that factor. The organizational culture concept also includes corporate culture; therefore, instead of corporate culture, the author chooses organizational culture as a suitable title for this factor. Likewise, information technology covers technology infrastructure and application systems both or management leadership and support cover every aspect of top management and leadership support, support and commitment of CEO, top management, leadership concept. A similar process follows for other factors also.

Table 2: List of knowledge management success factors

Sl	Factors	Authors
01.	Information technology	Sharafat (2018), Samad et al. (2014), Sedighi and Zand (2012), Lehner & Hass (2010), Conley & Zheng (2009), Jennex and Olfman (2005), Wong (2005), Wong & Aspinwall (2005), Choy and Suk (2005), Chourides et al. (2003), Moffett et al. (2003), Hasanali (2002), Davenport and Probst (2002), Bixler (2002), Andrew et al. (2001), Stankosky and Baldanza (2000), Choi (2000), Arthur Anderson Business Consulting (1999), APQC (1999), APQC (1999), Ruggles (1998), Davenport et al., (1998), Earl (1997), Skyme & Amidon (1997), Arthur Anderson and APQC (1996)
02.	Organizational culture	Sharafat (2018), Samad et al. (2014), Sedighi and Zand (2012), Lehner & Hass (2010), Conley & Zheng (2009), Akhavan et al. (2006), Jennex and Olfman (2005), Wong (2005), Wong & Aspinwall (2005), Choy and Suk (2005), Moffett et al. (2003), Hasanali (2002), Andrew et al. (2001), Arthur Anderson Business Consulting (1999), APQC (1999), Liebowitz (1999), Davenport et al., (1998),

		Skyme & Amidon (1997), Earl (1997), Arthur Anderrson and APQC (1996)
03.	Management leadership and support	Samad et al. (2014), Sedighi and Zand (2012), Lehner & Hass (2010), Conley & Zheng (2009), Akhavan et al (2006), Jennex and Olfman (2005), Wong (2005), Wong & Aspinwall (2005), Choy and Suk (2005), Hasanali (2002), Davenport and Probst (2002), Bixler (2002), Stankosky and Baldanza (2000), Choi (2000), Liebowitz (1999), APQC (1999), Davenport et al., (1998), Skyme & Amidon (1997), Arthur Anderrson and APQC (1996)
04.	Organizational structure	Sedighi and Zand (2012), Conley & Zheng (2009), Akhavan et al. (2006), Wong (2005), Wong & Aspinwall (2005), Hasanali (2002), Bixler (2002), Andrew et al. (2001), Stankosky and Baldanza (2000), Choi (2000), Davenport, et al., (1998), Skyme & Amidon (1997)
05.	The dedicated knowledge management team	Sedighi and Zand (2012), Lehner & Hass (2010), Conley & Zheng (2009), Akhavan et al. (2006), Wong (2005), Wong & Aspinwall (2005), Choy and Suk (2005), Moffett et al. (2003), Arthur Anderson Business Consulting (1999), Liebowitz (1999), Ruggles, (1998), Earl (1997)
06.	Knowledge management strategy and purpose	Sharafat (2018), Sedighi and Zand (2012), Lehner & Hass (2010), Akhavan et al. (2006), Jennex and Olfman (2005), Wong (2005), Wong & Aspinwall (2005), Chourides et al. (2003), Liebowitz (1999), Davenport, et al., (1998)
07.	Training	Samad et al. (2014), Lehner & Hass (2010), Conley & Zheng (2009), Akhavan et al. (2006), Jennex and Olfman (2005), Wong (2005), Wong & Aspinwall (2005), Choy and Suk (2005), Davenport and Probst (2002)
08.	Process & activities of knowledge management	Sedighi and Zand (2012), Lehner & Hass (2010), Conley & Zheng (2009), Jennex and Olfman (2005), Wong (2005), Wong & Aspinwall (2005), Ruggles, (1998), Skyme & Amidon (1997)
09.	Measurements to calculate targets, goals, and improvement	Conley & Zheng (2009), Jennex and Olfman (2005), Wong (2005), Wong & Aspinwall (2005), Choy and Suk (2005), Hasanali (2002), Davenport and Probst (2002), Arthur Anderrson and APQC (1996)
10.	Motivational aids	Lehner & Hass (2010), Conley & Zheng (2009), Wong (2005), Wong & Aspinwall (2005), Malhotra and Galletta, (2003), Liebowitz (1999), Davenport et al. (1998)



11.	Knowledge system	Lehner & Hass (2010), Akhavan et al (2006), Jennex and Olfman (2005), Choy and Suk (2005), Andrew et al. (2001), Liebowitz (1999), Davenport et al., (1998)
12.	Knowledge sharing and acquisition	Sharafat (2018), Lehner & Hass (2010), Akhavan et al (2006), Davenport and Probst (2002)
13.	Security/protection of knowledge	Andrew et al. (2001), Jennex and Olfman (2000), Sage and Rouse (1999)
14.	Corporate and business strategy	Conley & Zheng (2009), Davenport and Probst (2002), Skyme & Amidon (1997)
15.	Human Resource Management	Wong (2005), Wong & Aspinwall (2005), Chourides et al. (2003)
16.	KMS contents with a clear goal and purpose	Lehner & Hass (2010), Jennex and Olfman (2005)
17.	Meta-communication of knowledge management	Lehner & Hass (2010), Davenport et al., (1998)
18.	Learning	Bixler (2002), Stankosky and Baldanza (2000)
19.	Knowledge storage	Akhavan et al. (2006)
20.	Knowledge capture	Akhavan et al. (2006)
21.	Knowledge obtainers	Andrew et al. (2001)
22.	Knowledge transfer	Andrew et al. (2001)
23.	Knowledge ontologies, and repositories	Liebowitz (1999)
24.	KMS support functions	Jennex and Olfman (2005)
25.	Personality	Lehner & Hass (2010)
26.	Trust	Akhavan et al. (2006)
27.	Employee empowerment	Choy and Suk (2005)
30.	Employee involvement	Choy and Suk (2005)
31.	Total Quality Management	Chourides et al. (2003)
32.	User commitment	Malhotra and Galletta, (2003)
32.	Macro-environment	Moffett et al. (2003)
33.	Marketing	Chourides et al. (2003)

### 3 FINDINGS

The semi-systematic literature review help to achieve the findings mentioned above on critical success factor and knowledge management success models. The review process starts with finding the most appropriate search words for the research. After the initial brainstorming, the author prepares a list of search words. Knowledge, definition of knowledge, knowledge management, knowledge management success model, knowledge management success factor, knowledge protection and knowledge management success factor, knowledge management drivers are some key search words for this thesis. The literature search conducts with a combination of two search approach. The author tries to utilize the university library facility to derive books on knowledge management. The other method is to search for articles on the internet with a specialized search engine called Google Scholar. Two facts, i.e. publication date and citation number, take into consideration while choosing the articles for the review. Though considering top journals was one of the critical steps of the proposed methodology for the research, but while working on the research, the author tries to be non-bias towards any journals. The author takes consideration of the articles, which consist of essential information for the thesis regardless of the publishing journal. The number of related articles for knowledge management success models is not vast. Therefore, no inclusion or exclusion criteria maintain while choosing the articles or information for the thesis.

Based on the above process, a list of thirty-three knowledge management success factors created in the previous chapter. From the list, it is clear that authors have different perceptions about the critical success factors. The factors can divide into two broad aspects, organization related aspects, and knowledge related aspects. A list of the division of the factors given in table 3 below.

Table 3: Division of the success factors

<b>Organization related success factors</b>	<b>Knowledge related success factors</b>
Information technology	Knowledge management strategy and purpose
Organizational culture	Process & activities of knowledge management
Management leadership and support	Knowledge system
Organizational structure	Knowledge sharing and acquisition
The dedicated knowledge management team	Security/protection of knowledge
Training	KMS contents with a clear goal and purpose
Measurements to calculate targets, goals, and improvement	Meta-communication of knowledge management
Motivational aids	Knowledge storage
Corporate and business strategy	Knowledge capture
Human Resource Management	Knowledge obtainers
Learning	Knowledge transfer

Personality	Knowledge ontologies, and repositories
Trust	KMS support functions
Employee empowerment	
Employee involvement	
Total Quality Management	
User commitment	
Macro-environment	
Marketing	

There are nineteen organizational-related factors exist compared to the thirteen knowledge related factors. From the beginning of finding critical knowledge management factors, authors give more importance to the organizational-related factors. That is the reason why there are no knowledge-related factors in the top five of the knowledge management success factor list (see table 2). Till now, researchers believe information technology and organizational culture are the two most important factors for achieving knowledge management success. The number of authors mentions these factors in their articles, and the year of the publication proves such belief.

Factors related to knowledge come into the scene from 1997 when David Skyrme and Amidon Debra first mention about knowledge process and activities as a critical success factor. Next year, Thomas H Davenport, David W. De Long, and Michael C. Beers introduce strategy and purpose knowledge management, knowledge system as a success factor. With time, authors give more importance to strategy and purpose knowledge management than the other knowledge related success factors. In the next few years, authors try to segregate the knowledge management process into different parts like knowledge ontologies, and repositories, knowledge capture, knowledge storage, knowledge obtainers, knowledge transfer. But none of them attracts attention and recognition as an essential knowledge management success factor. A separate detailed list of knowledge related success factors is given below in table 4.

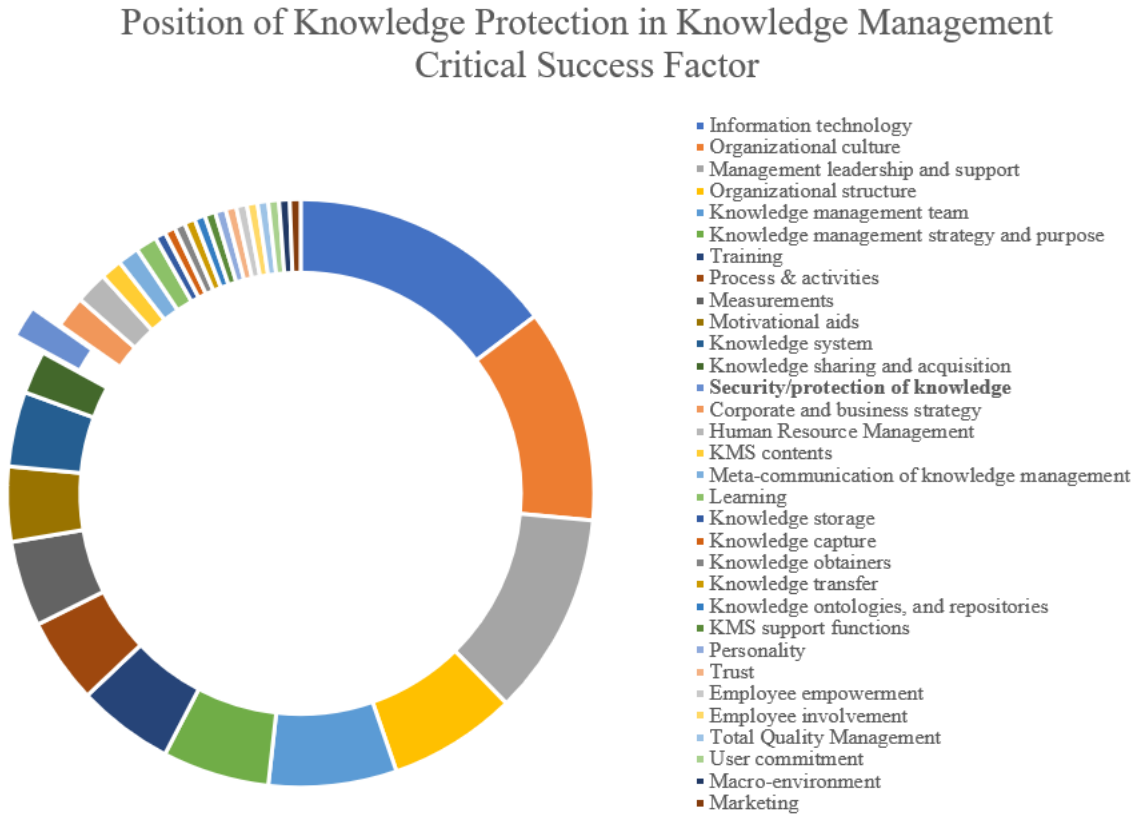
Table 4: a separated list of knowledge related success factors with its authors

SI	Factors	Authors
01.	Knowledge management strategy and purpose	Sharafat (2018), Sedighi and Zand (2012), Lehner & Hass (2010), Akhavan et al. (2006), Jennex and Olfman (2005), Wong (2005), Wong & Aspinwall (2005), Chourides et al. (2003), Liebowitz (1999), Davenport, et al., (1998)
02.	Process & activities of knowledge management	Sedighi and Zand (2012), Lehner & Hass (2010), Conley & Zheng (2009), Jennex and Olfman (2005), Wong (2005), Wong & Aspinwall (2005), Ruggles, (1998), Skyme & Amidon (1997)

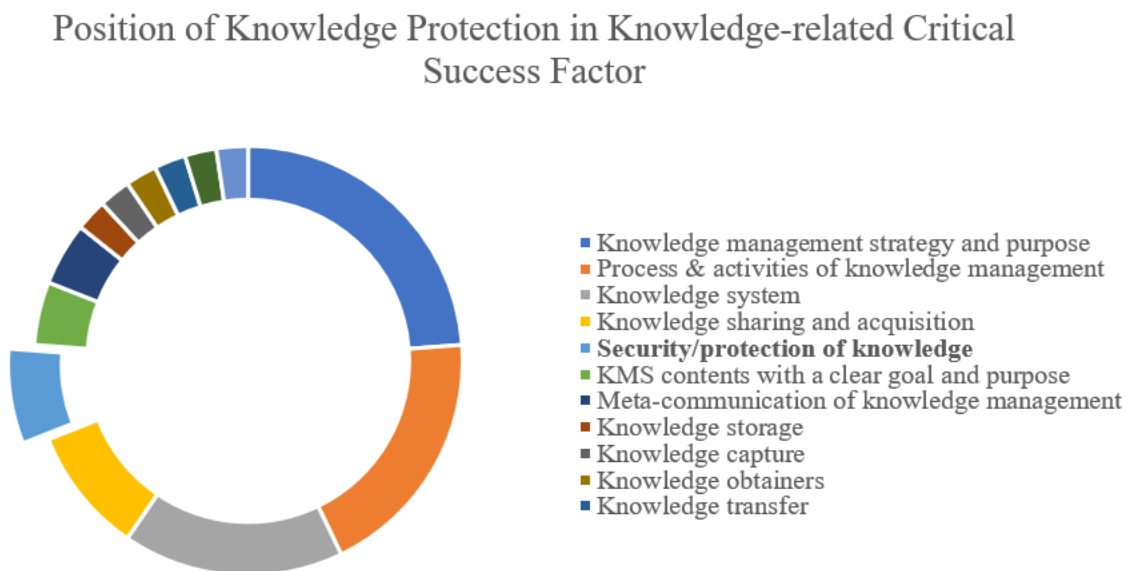
03.	Knowledge system	Lehner & Hass (2010), Akhavan et al (2006), Jennex and Olfman (2005), Choy and Suk (2005), Andrew et al. (2001), Liebowitz (1999), Davenport et al., (1998)
04.	Knowledge sharing and acquisition	Sharafat (2018), Lehner & Hass (2010), Akhavan et al (2006), Davenport and Probst (2002)
05.	Security/protection of knowledge	Andrew et al. (2001), Jennex and Olfman (2000), Sage and Rouse (1999)
06.	KMS contents with a clear goal and purpose	Lehner & Hass (2010), Jennex and Olfman (2005)
07.	Meta-communication of knowledge management	Lehner & Hass (2010), Davenport et al., (1998)
08.	Knowledge storage	Akhavan et al. (2006)
09.	Knowledge capture	Akhavan et al. (2006)
10.	Knowledge obtainers	Andrew et al. (2001)
11.	Knowledge transfer	Andrew et al. (2001)
12.	Knowledge ontologies, and repositories	Liebowitz (1999)
13.	KMS support functions	Jennex and Olfman (2005)

The position of knowledge protection appears in literature before knowledge sharing. Despite that till now, only three authors acknowledge the importance of knowledge protection and enlist it as a success factor of knowledge management. In 1999, Andrew P. Sage, and William B. Rouse mentioned the protection of knowledge in their article "Information systems frontiers in knowledge management" published in information systems frontiers. Next year Jennex and Olfman and consequent year Andrew et al. indicate it as a critical success factor. It is important to note that, after 2001, no other author recognizes the importance of knowledge protection in their articles. On the other side, the prominence of knowledge sharing comes into the scene in 2002 when Thomas H. Davenport and Gilbert Probst mention it in "Siemens' knowledge journey." From there till 2018, few authors acknowledge knowledge sharing from time to time.

Though some authors acknowledge the importance the knowledge protection, the factor always keeps at the lower order in their list. Even here, knowledge protection place in number 13 between all types of 33 factors (table 2) and place in number 5 between knowledge-related factors (table 4). The position of security/protection of protection between knowledge management success factors and knowledge-related success factors in knowledge management observe from the pie presented in below figure 7. Authors of only three articles mention it in their articles. Andrew et al. (2001) identified seven critical factors for the success of knowledge management, and the protection of knowledge is the last one among them. Jennex and Zyngier (2007) mention that security and knowledge protection is the least recognized critical success factor. Even it is in number twelve, in their ranking of factors which is the last place.



a) Position of Knowledge Protection in Knowledge Management Critical Success Factor



b) Position of Knowledge Protection in Knowledge-related Critical Success Factor

Figure 7. Position of knowledge protection in between different success factors

At this point, the knowledge management system's success models will analyze. The five models that consider in this thesis are DeLone and McLean IS success model, Maier KMS success model, Lindsey KM effectiveness model, Massey, Montoya-Weiss, and Driscoll KM success model, Jennex and Olfman KM success model. The criteria set for choosing a success model is which type of organizations the researchers consider while developing the models and desire organizations for this case are technology and R&D organizations. DeLone and McLean IS success model considers R&D organization, Maier KMS success model, Lindsey KM effectiveness model consider all type of organization which includes technology and R&D organization, Massey, Montoya-Weiss, and Driscoll KM success model consider technology organization and Jennex and Olfman KM success model consider engineering organizations. Therefore, all these five models need to analyze to find out how much importance they provide knowledge protection.

DeLone and McLean IS success model, Maier KMS success model does not mention anything about protection. Even Massey, Montoya-Weiss, and Driscoll KM success model also do not have anything related to knowledge protection. Lindsey develops his success model by combining two separate theories called organizational capabilities perspective and contingency perspective. Organizational capabilities perspective theory consists of a knowledge process where knowledge protection is an essential part along with knowledge acquisition, conversion, and application. The author of the theory accepts that knowledge protection study is not well enough. Still, the importance of it is high because of the competitive advantage that an organization can gain from the protection of knowledge.

Jennex and Olfman do not incorporate knowledge protection directly in their success model. However, one of the reasons behind the model development was their belief on what is valuable should be protected. Based on the previous study done by Jennex, they urge that organizations consider protection to prevent unauthorized change in their data, information, and knowledge. Thus, security design is important for them to protect their knowledge base or database. It is possible to state that such type of protection is much more concerned with the system where knowledge stores. Researchers believe that such security is built-in in the system. Because of that, more concern needs to give to the maintenance of knowledge availability, integrity, and confidentiality. Such thought tends them to ignore the protection factor during their research. Jennex and Olfman accept the above fact and also acknowledge that when they develop their model, then there was no direct connection of knowledge protection with their model. But there is plenty of scopes to accommodate it.

When they consider knowledge management systems performance in the model, they choose only the creation of knowledge, knowledge storage, and knowledge transfer but ignore knowledge protection. At the same time, knowledge protection is similarly crucial as the other three. Because security is essential in the storage and transfer phase. So, incorporate protection in these phases will increase the security factor of the whole system. Moreover, the security of knowledge needs

to be a part of a knowledge management strategy. Only implement protection for databases, networks, websites, or technical devices will not completely secure knowledge management. Being a part of the strategy will help more in this case. Employees and technical resources' knowledge protection, sharing protected knowledge with partners and competitors, sharing knowledge with the users while developing or marketing any product is equally important like implement protection for different devices and websites. Every employee work for an organization has its knowledge and experience; the organization needs that at different times while making any decision and plan for a future goal. If any employee leaves the organization, there are high chances to lose that knowledge, and it is essential to secure that knowledge. During the partnership with other organizations or with competitors, many knowledge-related issues come in the scene. In every partnership, some knowledge sharing is necessary and to which extend the organization should share knowledge and protect knowledge that needs to be exact. Also sharing knowledge with users is important, especially while developing any new product or process. Hiding knowledge at an extensive level creates a barrier in the relation between the user and researcher. Such barrier tends towards the failure of the development. Therefore, identify the degree of knowledge protection in every aspect of knowledge management is important.

After assessing all the five knowledge management success models, the position of the critical success factor 'Knowledge Protection' is clear. Only two models acknowledge the importance of knowledge protection and the other three models overlook it. A summary of the finding provides in below table 5.

Table 5 Summary of assessing knowledge management success model

KM Success Model →	DeLone and McLean IS success model	Maier KMS success model	Lindsey KM effectiveness model	Massey, Montoya-Weiss, and Driscoll KM success model	Jennex and Olfman KM success model
KM Success factor ↓					
Knowledge protection	No connection	No connection	Acknowledge the factor	No connection	No direct connection

## 4 DISCUSSION & CONCLUSIONS

### *4.1 Addressing the Research Question*

Initially, the study began with the purpose of assessing knowledge protection's role in knowledge management models. Therefore, firstly, the author tries to discover the list of critical success

factors of knowledge management. The target was to know whether the security of knowledge exists in that list or not. Secondly, based on the previous result, the author tries to find out the importance of knowledge protection in knowledge management success models.

The overall result of the research is acceptable but not completely satisfactory. The author can find out the value of knowledge protection in the knowledge protection model. It is not entirely satisfactory because the significance of knowledge protection is very low. Out of the five models that the author considers, three of them don't consider knowledge protection at all. Only one model acknowledges the importance of knowledge protection. Another model discusses it in the background. The situation was pretty much the same while finding critical success factors for knowledge management. Only three research articles addressing knowledge protection and that too, with a considerable time gap. In the last two decades, no researcher believes that knowledge protection is a critical success factor.

Lindsey's model of knowledge management success acknowledges knowledge protection only in knowledge process capacity. Whereas in their first knowledge management success model, Jennex and Olfman overlook the direct involvement of knowledge protection. Though later they state that while developing the model, security was an aspect of their thinking. Despite the acknowledgement, when they reassess the model, they only incorporate security as an integral part of the knowledge management strategy. Though some researchers already work on the topic, the result of the research done by the author lightens different aspects. Continuous research is going on the finding of critical success factors. Still, for a long time, no research has been done to know the actual value of knowledge protection in knowledge management. Moreover, this research gives a clear indication that the valuable role of knowledge protection is still minimum. There are possibilities to incorporate knowledge protection in knowledge management success models.

## ***4.2 Evaluation of the Thesis***

Overall, the author achieves the aim of the research up to a certain extent, but the result is surprising. A long list of knowledge management success finds by the author and knowledge protection exists in that list. The list covers different types of knowledge management success factors such as technology, knowledge, organization and management related success factors. Of course, there is a possibility that the list doesn't cover all the success factors. Due to the research and time limitation, it is difficult to find out all the articles related to critical success factors. Despite the limitation, the list of the success factor is quite extensive. The proposed list not only contains knowledge protection as a success factor but also provides a general idea about other crucial information like the year when first-time researchers start acknowledging it as a success factor, the total number of researchers recognizing it as a success factor until today, along with their year of identification, all of this valuable information is available in the list.



Based on the preliminary achievement of finding knowledge protection in the success factor list, the next goal is to find the importance of knowledge protection in knowledge management success models. Again, due to the research and time limitation, it is difficult to find out all the success models exist in the literature, but the authors manage to find quite a few models. After evaluating all of those models separately, the result of the thesis is much clear. Most of the success model's origin from an old model, and researchers modify that model with time. Therefore, a limitation on the thought of the researchers is visible. Every researcher alters the model based on their research objective. None of them tries to find a more general model. Nevertheless, the author was able to find out one model which considers knowledge protection and one model which acknowledges the significance of knowledge protection in the background of the development of that model. Overall, the importance of knowledge protection in the knowledge management success model is relatively low.

After completing the research on the critical success factors and knowledge management success models, the limitations are quite visible. Because of the low value of knowledge protection, the scope of development of a new model where knowledge protection will secure its appropriate importance is very much possible. Some fundamental limitations that come out during the study are:

- 1) Less concern on the knowledge related critical success factors
- 2) Ignorance of knowledge protection aspect in the knowledge strategy of success models
- 3) Overlook the availability of knowledge for the users while considering user satisfaction in the success models

First, some authors identify knowledge-related critical factors over the years, but unfortunately, no further research conduct after that. Some of them identified 20 years back and then no update on their effect on knowledge management. Therefore, those factors remain underrated compare to critical organizational factors.

Second, while developing knowledge management success models, researchers include knowledge strategy as a part of those models. But unfortunately, the security of knowledge was not a part of the knowledge strategy. All the other parts will fall if any breach happens during knowledge capture, share, or storage. Therefore, it will be too risky to ignore the security of knowledge in the knowledge strategy.

Third, almost all the knowledge management success models acknowledge the importance of a user or user satisfaction. But all of them ignore one fact of the availability of knowledge or information. Due to the protective nature of researchers, the knowledge flow towards the users of the innovation always hamper. There is no indication of the effect of knowledge protection on user satisfaction.

### ***4.3 Future Research***

Knowledge management is still an emerging field. Researchers are still trying to explore various aspects of it. Therefore, neither the list of knowledge management critical success factors is accurate nor the development of knowledge management success models is decisive. Most likely, there are many scopes for both topics to expand further in the near future.

However, the limitations described above are just the thoughts of the author. But they can be useful for upcoming research. Find out the consequence of success after the addition of knowledge protection in knowledge management success models can be an exciting topic for future research. There are at least two spots where researchers can address knowledge protection to check its effect on the models. User satisfaction and knowledge strategy are those key-spots. How extensive knowledge protection affects user satisfaction or finds out the limit of knowledge protection for achieving the highest level of user satisfaction might be a research topic for the future. Also, how the success of knowledge management models evolves after including knowledge protection in knowledge strategy would be something interesting to explore.

Similarly, Researchers can do some more extensive research on knowledge management success factors. Only a few pieces of research have been done on it till now. There is still a lot of scopes to do some empirical research to find the significance of knowledge protection as a knowledge management critical success factor.

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